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**Supervised Project Report
(ANTA604)**

Christchurch Antarctic Link – An opportunity for on-site interpretation at the Christchurch Botanic Gardens

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Abstract/executive summary (ca 200 words):

Christchurch's Botanic Gardens provide an opportunity to celebrate the role that Canterbury has played in the history of Antarctic exploration. The Heroic Age polar explorers needed to calibrate navigational instruments in the Southern Hemisphere before heading to Antarctica. Many of them came to do this at the Magnetic Observatory, based in the Christchurch's central Public Gardens. This was the start of an ongoing and vital link between Christchurch and Antarctica. There is one building, the Workshop, remaining from the Magnetic Observatory that operated from 1901 to 1969. This report suggests developing on-site interpretation panels to provide park visitors with an understanding of the historical significance of the site. Given the Garden setting, the panels can also introduce some information on Antarctica biota. A visitor questionnaire is suggested to gauge visitor knowledge and interest, which will be useful when resources are available to develop a visitor experience within the Workshop.

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Introduction

Christchurch has long been associated with Antarctica.

It has been the stepping-off place for many expeditions since the earliest days of Antarctic exploration. Both early famous English Antarctic explorers Robert Falcon Scott and Sir Ernest Shackleton used Christchurch as a base when venturing south. Today it continues the strong connection, not only by being a significant city and port in close geographical proximity – it is also the home of Antarctica New Zealand (AntNZ) and one of the five official Gateway Cities to the Antarctica. There are also a number of important organisations based here – Gateway Antarctica, the Council of Managers of Antarctic Programmes, Antarctic Heritage Trust and the NZ Antarctic Society. The outcome of the work of these Antarctic-focused organisations is a tremendous amount of learning, a wide breadth of knowledge and understanding derived from the people visiting the Southern Ocean and the frozen continent through Arts, Science, Research and Tourism.

There are some opportunities for Christchurch residents and visitors to experience some of this knowledge within the city, such as attending public lectures and visiting the Canterbury Museum and the International Antarctic Centre, but I suggest more can be done to promote the importance of Antarctica to the city. One potential opportunity to do this is in the centrally located Christchurch Botanic Gardens. The Gardens receive over one million visitors per year, as well as running education programmes and a visitor centre.

Also located in the Gardens is the Magnetic Observatory Workshop. This building is what remains of a science complex that included the Magnetographic House and an Absolute (Magnetic) House. These were built in the early 1900s and were used over the next decade by explorers to calibrate instruments before heading to Antarctica (CCC, 2010).

There is also a weather station adjacent to the Magnetic Observatory Workshop. Weather records have been made in or near the Christchurch Botanic Gardens since 1876. Neither of these sites, nor the Gardens generally, has any displayed information to inform the public about the history or purpose of the sites or their links with Antarctica.

The Christchurch Botanic Garden Charitable Trust (BGT) is currently initiating a project to fund-raise for the development of a visitor experience based in the Workshop (BGT, 2017). This project is in the planning stage and early ideas include interactive media and enhancements to the Workshop building to provide a significant visitor experience in the Botanic Gardens. A timeframe for production and installation is not yet known although the project is a priority for 2017 (J. Clemens, personal communication, February 10, 2017).

This report proposes undertaking a formative evaluation at the Magnetic Observatory site by taking the opportunity to install some on-site information in the short term and seek visitor feedback to assist with the planning and production of permanent interpretation displays focused on the Magnetic Observatory.

The report suggests some concepts and themes that could be interpreted at this site in three panels. It also includes a proposed visitor questionnaire for formative evaluation and reviews some of the fundamentals of good interpretation practice.

What is interpretation and why use it at this site?

In the context of this proposal, interpretation means explaining the history and value of the site. It seeks to provide an understanding about protecting heritage and celebrating it. Rather than presenting a raft of facts, this proposal is suggesting on-site interpretation to present snippets of information from the past, and the current times, and make suggestions of how this site relates to the future. This is in the hope of sparking an interest in and understanding of, the site and the Christchurch-Antarctica relationship. Learning about our past, helps us to deal with the future (McGrath & Curthoys, 2009).

It is challenging to limit the amount and breadth of information that could be covered at this site. As a French poet and novelist so eloquently said:

Do not try to satisfy your vanity by teaching a great many things. Awaken people's curiosity. It is enough to open minds; do not overload them. Just put there a spark. If there is some good flammable stuff, it will catch fire (Anatole France, c1900)

The Interpretation Network New Zealand website contains a useful interpretation brief template. One of the questions asked in this template is "What is the ONE thing I really want my visitors to know/think/feel." This is a pertinent question and helps emphasise the importance of quality of information versus quantity.

There are many methods of interpretation including interactive displays, guided tours, self-guided trails, listening posts and models. Personal communication devices and other technology provide other potential opportunities for communicating with site visitors. However, for this proposal the more traditional method of on-site panels are suggested. They are cost effective and, being common in many park situations, are known and used by site visitors. They can convey information to help visitors appreciate and value the history and significance of the site (Department of Conservation [DOC], 2005).

The Proposal

This project supports recognising the significance of the Magnetic Observatory site with the production of interpretation panels that can be installed on site. The panels can be used to interact with visitors, using a questionnaire to find out if the information is accessible to them and if the intended information has been understood.

The educational objectives for this proposal are to raise awareness of:

- the roles of the Workshop and what Magnetic Observatory
- the significance of the site to early polar explorers like Scott and Shackleton
- the links between Christchurch and Antarctica
- terrestrial plant life in Antarctica.

The following section provides background information and makes recommendations for the content of the panels

Panel concepts

Panel 1

This panel will focus on the past, present and future connections between Christchurch and Antarctica, and the significance of Magnetic Observatory

Past

“Much of the history of Antarctic exploration has flowed through Christchurch” Sir Edmund Hillary (Wills, 2008, p. 15).

The early Antarctic explorers laid a foundation for a strong and ongoing connection between Christchurch and Antarctica. Benjamin Morrell was the first “Antarctican” to visit Canterbury. An American sealer and explorer he called in to Lyttelton Port in 1830 after sailing to the Auckland Islands. Whaling ships followed and Lyttelton became a vital port during the heroic era of discovery and expeditions to the frozen continent. One of the most well-known Antarctic explorers, Captain Robert Falcon Scott (1868–1912), came to Christchurch on his first journey south in 1901 in the ship *Discovery*. The main reason he visited was to calibrate instruments at the newly opened Magnetic Observatory (CCC, 2013) situated in the Christchurch Botanic Gardens. Ernest Shackleton, who was a member of the 1901 expedition, led his own team to Antarctica in 1907. His team also visited the Observatory on their way south. Other Heroic Era explorers continued to use the Observatory for about a decade with one describing it “more beautiful and in every way better even than that at Kew” (Armitage, as quoted in CCC 2013, p117). The phrase “Heroic Era” was coined by historian Gordon Hayes to describe the years of Antarctic exploration and research between 1906 and 1914 (Atkin, 2013).

Present

Since the early Antarctic expeditions Christchurch remains a vital link to Antarctica. It can now be considered New Zealand’s “Antarctic hub”. Lyttelton continues to be a significant loading and servicing port for research and supply ships for various nations. The airport sees flights to McMurdo and Scott Base stations. The AntNZ Office is in Christchurch, as are offices for programmes for the United States, Korea and Italy. Christchurch is one of only five cities in the world recognised as Antarctic Gateway Cities.

Christchurch is also the home of numerous Antarctic agencies including The International Antarctic Centre, the Council of Managers of National Antarctic Programmes (COMNAP), Gateway Antarctica Canterbury University, Antarctic Heritage Trust, and the recently formed Antarctic Office.

Studies by Lincoln University have revealed that Antarctic related activities contribute over \$150 million dollars to the New Zealand economy, with the majority of this settling into Canterbury (Cropp, 2016).

Future

Climate change is a topical subject for our community. “Antarctica’s past can tell us about our future” (AntNZ 2017, p1). There are numerous researchers and scientists working on answering questions that Antarctica poses, to provide for forecasting.

As AntNZ explains:

New Zealand’s current research is about

1. the past helping to predict what happens in the future— mostly through analysing sediments and ice.
2. measuring biological change to understand how animals and plants adapt to change. By measuring the changes in behaviour and life history, scientists expect to detect early warning signs of a changing planet.
3. learning more about how Antarctica drives the planet’s climate. It is now recognised that the Southern Ocean and Antarctica have a great influence or drive on the world’s climate. Changes to the ice sheets will affect the rest of the planet.

Some of this Antarctic Research is driven by Canterbury organisations. Research undertaken at Christchurch’s universities spans numerous disciplines and includes: Antarctic sea ice thickness: harbinger or change in the Southern Ocean (Dr Wolfgang Rack); mercury contamination in penguins (Natalie Pilcher); marine mammals (Dr Regina Eisert); and resilience of Antarctic coastal marine ecosystems (Dr Ian Hawes).

Panel 2

This panel will focus on the remaining workshop building and the Magnetic Observatory complex.

Much of the following is sourced from Magnetic Observatory Workshop/Museum section of the Conservation Plan for Hagley Park and the Christchurch Botanic Gardens, prepared by Louise Beaumont (CCC 2013). Sue Molloy, Botanical Resources Coordinator for the Christchurch Botanical Gardens, also has considerable knowledge of this building.

There was a swell of scientific interest in many fields in the 1850s and beyond. In 1899 the Australasian Society for the Advancement of Science recommended a magnetic observatory be constructed in New Zealand. At this time, the origin of the Earth’s magnetic field was still a mystery to science. There were already 50 observatories in the northern hemisphere but only one in Australasia, in Melbourne (Cree 1903). Additional observatories were needed to advance knowledge in this area.

In 1900 The Botanic Garden (43° 31’ 50” S, 172° 37’ 18” E) was chosen as a suitable location for a magnetic observatory. Its wilderness quality was valued, being free from disturbances (Cree, 1903) and unnecessary movement, uncultivated and covered with tussock and lupins. (CCC 2013).

Three buildings were constructed.

- The Absolute Magnetic House, containing a magnetometer that measured the strength and direction of the magnetic field.
- The Magnetographic House, whose magnetograph in the cellar recorded changes in the magnetic field over time.
- An administration office, added onto over the years, which at one stage accommodated 32 staff (CCC, 2013).

During the first 10 years, visiting expeditioners used the Magnetic Observatory to calibrate instruments before heading to the “Unknown Southern Land” or *Terra Australis Incognita*. Records note visits from Captain Robert Scott in 1901 and 1910 and Earnest Shackleton in 1907 (Stone, 2015). Scientists from the Carnegie Institute also travelled to Christchurch to use the instruments at this site.

The efficacy of the Magnetic Observatory was affected by the installation of nearby electric trams (Atkin 2013), and some of the instruments were moved to Amberley in 1913. There were numerous structural changes to the buildings and their use until 1969. In 1970 the Observatory managers, Department of Scientific and Industrial Research (DSIR), closed the facility and the grounds were handed back to the Christchurch City Council (CCC) (CCC, 2013).

Another small building was moved onto the site in 1941 and used as a workshop. This is the sole remaining building of the Magnetic Observatory complex. The building still contains a seismograph and remains part of the Primary Gravity Network (CCC, 2013). The seismograph recorded the numerous earthquakes and aftershocks since 4 September 2010, the date of the magnitude 7.1 Darfield event.

Panel 3

Sited in the centre of the “Garden City” Botanical Gardens, this panel provides an introduction to the natural life that occurs in Antarctica.

Antarctica's biology provides an early warning signal. Antarctic life is sensitive to changes in the environment. By measuring changes in the life history and behaviour of plants, microbes and animals, scientists will detect early warning signs of a changing world (AntNZ 2017, p.1).

It may come as a surprise to some that there is plant life in Antarctica. Early explorers reported barren landscapes devoid of plant life, but subsequent studies taking a closer look have revealed that there is an interesting and vital terrestrial biota. Much of this survives in ice-free areas such as exposed nunataks and rock cliffs (Tejedo et al., 2013). Given that the Continent is mostly snow and ice, terrestrial ecosystems cover only around 0.32% of the land surface. The limitations on terrestrial ecosystems include lack of available water and nutrients and extreme temperature and radiation (Convey et al., 2008)

Some specialised plants such as the psychrophilic (cold loving) snow algae, live in snow banks (Australian Antarctic Division [AAD], 2015) and others that are heat tolerant in geothermal ground on volcanoes (Broady 2015). There are only two vascular plants native to Antarctica. One is a small cushion-forming plant the Antarctic pearlwort, (*Colobathus quitensis*), the other the Antarctic hair grass (*Deschampsia antarctica*). Both are found in the warmer northern and western parts of Antarctica. (AAD, 2016, Broady, 2015). There are, however, a large number of “lower” plants: lichens (over 200 species), mosses and liverworts (over 50), fungi, and over 700 species of alga (AAD, 2016). Algae are not classified as plants, but play a significant role in the Antarctic ecosystem and are fascinating in their own right, and an integral part of the food web. They occur from microscopic single cells to large, colourful seaweeds. Snow algae may have compounds of commercial interest for sun screens and low temperature enzymes (AAD, 2016).

In Continental Antarctica, lichens are the mainstay of vegetative life. They occur in most areas where it is possible for plant life to exist, and demonstrate impressive adaptations to harsh conditions. They can photosynthesize in sub-zero conditions, as low as -17°C . One species, *Usnea sphacelata*, survives on exposed windswept mountain ridges, where temperatures may drop as low as -50°C in winter, and which in summer are exposed to intense solar radiation. Most are slow growing and photo comparisons between 1911, taken by members of Scott's expedition, and 1993 show no detectable growth (Broady, 2015). Some of the large lichen are estimated to be 5,000 years old. About 50% of Antarctic lichens are endemic (Broady, 2015).

There is extensive literature published on Antarctic botany and ecology, with many studies on the terrestrial ecosystems reaction to environmental change. Some people may find facts on lichen and algae incredibly fascinating, but in this context it is assumed that the majority of visitors to the Botanic Gardens may have limited knowledge about Antarctic plant life. It is proposed that the panel on plant life is confined to explaining that they occur in the harsh environment, and are diverse.

Who for?

It is important to consider the intended audience when planning to produce information or interpretation. The material and presentation needs to reflect who the information is for (McGrath & Curthoys, 2009). The panels, as outlined above, are aimed at casual contact by visitors to the Botanic Gardens. Past surveys have shown that 50% of Garden visitors are from Christchurch and of the Internationals, 20% from the United Kingdom and 20% from Australia. It would be useful to know more about the Garden visitors and their perceptions of the provided information. For this reason it is proposed that some formative evaluation is done.

Formative evaluation

Establishing how effective on-site information is can be done with evaluation studies prior to permanent displays being produced. This evaluation is important to establish what the needs and interests of the “clients” are. Evaluation can be qualitative or quantitative, direct or indirect (DOC, 2005). For this proposal, the direct qualitative evaluation is suggested. This method involves asking or discussing people’s perceptions, opinions and attitudes directly, via a questionnaire. A quantitative study is based on such things as number of visits to information over a set time, and is not considered so useful for this project. Indirect evaluation involves observing what a person does when interacting with the information.

Evaluation of visitor perceptions can be done at all stages of on-site interpretation production.

Table 1: Evaluation can be done at different stages of interpretation production
(adapted from Meylan, 1995)

Interpretation panel stage	Type and rationale
Preplanning stage	Front end evaluation – looking for ideas
Planning Stage	Formative evaluation – will what is planned work?
Post production stage	Summative evaluation - how effective is the information?

Front end evaluation seeks to find out what topics and styles are preferred prior to detailed planning. Formative evaluation assesses the reaction of the visitor to a draft to provide feedback. Evaluation of information that is already in place is termed summative evaluation and can be used to determine the success of interpretation or provide a basis for planning new information (see Table 1).

This proposal supports formative/test evaluation. Test panels can be made and evaluated once panels are at a draft stage. The purpose of the evaluation or testing is to find out what visitors have learnt after reading the panels, and their perceptions of the information. From this feedback, more effective displays can be produced (Meylan, 1995). Formative evaluation provides an opportunity to change the information content or design to improve the success of the interpretation. One of the challenges of on-site interpretation is to gauge the quantity of information and at what level to pitch it. The test evaluation can assist with planning and fine-tuning panel production.

Testing can be cost-effective and visitor-friendly. Temporary test panels can be produced using low-cost material such as corflute, and placed in or near the intended site while the test evaluation is carried out through a questionnaire. A proposed questionnaire for the Botanic Garden Magnetic Observatory is provided in Appendix 2.

The questions for the evaluation are based on research designed to elicit specific information from the visitor. It is important to have a well-briefed and trained interviewer who is without bias and able to ensure that it is the panel, not the visitor, that is being tested.

Further opportunities

This project has concentrated on a proposal for on-site interpretation panels. While researching this site it has become apparent that there are other opportunities within the Christchurch Botanic Gardens to promote the Christchurch Antarctic link and the science learnings from Antarctica.

These opportunities include, but are not limited to:

- Development of an Environmental Education programme. The CCC currently offers a range of site-based education programmes. They are partly funded by the Ministry of Education, curriculum linked, and delivered by Council staff. Locations include city parks, recycling centres, and waste and water treatment plants. The lesson plans are written to ensure experiential learning that encourages sustainability and citizenship. Programmes on biodiversity are already delivered in the Botanic Gardens (CCC, 2016). Programmes are modified and updated periodically, based on the Council's priorities and schools' needs. A programme could be developed that focused on climate change using the resources in the Gardens and drawing on science from Antarctic research.
- Botanic D'Lights If this popular night-based event is repeated, lighting displays based on Aurora Australis and constructs of the Earth's magnetic fields would add an Antarctic element.
- School holiday programme self-guided tours. The treasure hunts organised for the school holidays could be amended to include Antarctic themes: "find" the site where Scott's expedition team once stood, "micro finds" for algae, moss and lichen.
- On line information. The Master Plan for the Botanic Gardens contains valuable information on the Magnetic Observatory. However, this is hidden in the depths of planning documents and requires a certain amount of preknowledge and stamina to find it. A specific page with attractive imagery could be developed and accessed from the Council's Botanic Garden website. As this on-site panel proposal has sought to do, the web page could highlight the past and current links between the Gardens and Antarctica.
- QR codes on on-site panels. To cater for different learning styles and for those who want more QR codes that linked to more in-depth information about the site and some of the data that was collected here could be used on the Workshop or signs.
- 3D imagery. As the recent Pokémon Go game demonstrated, people love to play with technology. With over 500 million downloads in 2016, this location based, augmented reality technology has been credited with increasing physical activity. (Wikipedia, 2017). There is an opportunity to bring some of the old buildings, scientists and Antarctic explorers to life through location-based (GPS/Hotspot) technology.
- Open Day. The Workshop contains information (photos, letters, text) installed on the inside walls of the building, giving an insight in to the past use of the area, interesting stories and some of the science that was collected here. Consideration could be given to have an open day when knowledgeable staff could interpret the displays for visitors. Kidfest could provide the frame work for promoting the Open Day.
- Other opportunities are only limited by imagination (and time and resources). Examples include dramatic productions, e.g. Scott visiting the site, then heading

south; temporary Antarctic displays in the Visitor Centre, with a focus on Antarctic biota; an Antarctic Garden – with larger-than-life sized models of mites, springtails and tardigrade; walk in freezers containing information on research on plants and or ice; microscopic displays, taking a close look, and so on.

Acknowledgements

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Appendix One: Draft Panels

It all started here – the Christchurch Antarctica connection

On this spot early Antarctic explorers calibrated navigation instruments before heading south to explore the then largely unknown frozen continent



Magnetographic House in the Christchurch Botanic Gardens 1915



Scott's Discovery expedition on the march to the South Pole 1902.

Why here?

Early Antarctic explorers came here because of the Magnetic Observatory. They needed to adjust compass differences between the magnetic and geographic poles, crucial for navigating in Antarctica.



Antarctic expedition ships *Morning*, *Discovery* and *Terra Nova* in Lyttelton 1904. Sailing from the northern hemisphere, explorers stopped in Lyttelton for provisions and servicing.



Have you seen a Hercules fly overhead? They fly several times a week from Christchurch Airport to Antarctica, if the weather allows.

The Christchurch Antarctica connection continues today with shipping and air links, and numerous Antarctic agencies based in Christchurch.



Antarctica's past can tell us about our future. Like the explorers of the past we are still learning about our world. Research from the Antarctic's ancient ice and sediments helps predict what our future planet might look like.

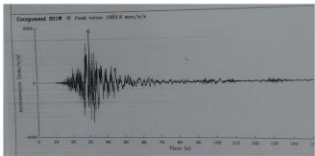


What happens in this building?



The Workshop, pictured above, is the only remaining building from the Magnetic Observatory, a complex of buildings housing various instruments from 1901 to 1969.

Gravity and earthquakes are measured here today.



The seismograph on this site helped scientists understand the devastating earthquakes in Christchurch in September 2010 and February 2011. This print out is from 4 September 2010.

Part of the observatory closed down in 1928. Electric trams installed nearby interfered with the instruments, and for a while, readings had to be taken after midnight when the trams were not running.



Cathedral Square circa 1910.



Up to 32 Department of Scientific and Industrial Research staff worked here in the Geophysical Division and Magnetic Survey between 1940 and 1969.



Magnetic Observatory Office, circa 1915.

You are here,
Workshop location.



Absolute Magnetic House, where a magnetometer measured the strength and direction of the Earth's magnetic field.



The Variation Observatory where the magnetograph in the cellar recorded changes in the magnetic field over time.



The Magnetic Pole moves, so measurements are needed to work out which way is 'south' from where the compass points.

The presence of the Magnetic Observatory was why Antarctic explorers chose Christchurch as a base for heading South.

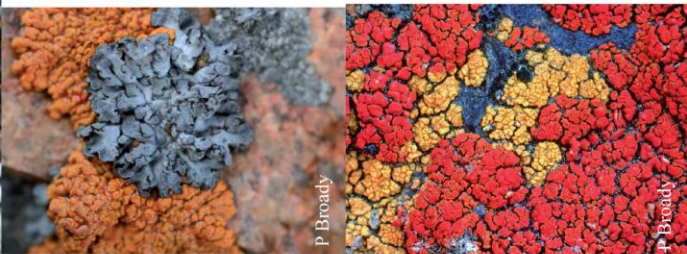
What would an Antarctic Botanic Garden look like?

It wouldn't need to be very big! Antarctic plants are small.

A main limiting factor for plant survival in Antarctica is available water.



There are only two flowering plants: pearlwort (above) and Antarctic hair grass.



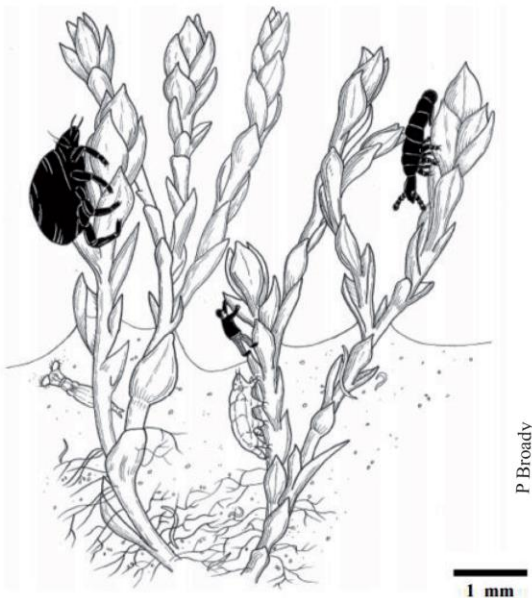
Lots of different types of lichens, mosses and algae live on rocks, on snow, in lakes and even on geothermal ground on volcanoes.



Fungi and moss live in the warmer and moist maritime Antarctica.



Can you see the lichen on the rock? This is the farthest south known lichen – at 86°30' on Mt Roland.



What would you see if you were small? All kinds of small hardy animals that live in Antarctic plants, like mites, rotifers and tardigrades.

A changing climate will change what grows in Antarctica. By studying the plant life, scientists can detect environmental changes.



Christchurch botanists, David Given and Colin Meurk getting amongst the lichen forest near Scott Base.

Appendix Two: Formative evaluation questionnaire

On site interpretation questionnaire

Proposed external on-site interpretation for Botanic Gardens Magnetic Observatory Workshop building

Introduce self

Reason for approach

The Council and The Botanic Garden Trust are working together to provide Garden visitors with more information on this building and the general site. Are you interested in helping by answering a few questions that will take less than 5 minutes of your time?

NO – Thanks

YES - Invite to read panels or If read panels:

- What do you like about this display? (prompt if necessary on topic or style)
- What do you not like about this display?
- Do you find anything confusing?
- What is a key message of each panel?
- If you were designing this, what would you change?

Thank you for your time

More information can be found on
<http://christchurchbotanicgardenstrust.co.nz/>